

We claim:

1. A transport assembly operative to transport a container from a first station to be placed in a second station spaced from the first station where the container is available for further processing operations, comprising:

- (A) a support frame;
- (B) a drive including a drive shaft rotatable about a drive axis;
- (C) an actuator arm having a first actuator arm end portion coupled to said drive shaft and extending radially therefrom to terminate in a second actuator arm end portion whereby rotation of said drive shaft acts to drive said actuator arm between
 - (1) a first angular position, and
 - (2) a second angular position;
- (D) a load arm having a first load arm end portion pivotally coupled to said actuator and a second load arm end portion opposite said first load arm end portion;
- (E) a transport head supported by said load arm and operative to releasably engage the container;
- (F) a constraining mount disposed on said support frame in spaced relation to the drive axis, said constraining mount engaging said load arm and operative to constrain the movement thereof so that said transport head moves between
 - (1) a container collection position wherein said transport head is located proximately to the first station whereat said transport head can engage a selected container when said actuator arm is in the first angular position, and

(2) a container placement position wherein said transport head is located proximately to the second station whereat said transport head can release the selected container when the actuator arm is in the second angular position.

2. A transport assembly according to claim 1 wherein said drive is reversible.
3. A transport assembly according to claim 1 wherein said actuator arm moves approximately 90° between the first angular position and the second angular position.
4. A transport assembly according to claim 1 wherein said transport head is a vacuum head and including a vacuum source, said vacuum head in fluid communication with said vacuum source.
5. A transport assembly according to claim 4 wherein said constraining mount has a vacuum passageway having an inlet and an outlet, the inlet being in fluid communication with the vacuum source and the outlet being in fluid communication with the vacuum head.
6. A transport assembly according to claim 4 wherein said vacuum head has
 - (A) a channel formed therein to receive a container, and
 - (B) at least one aperture located in the channel wherein said vacuum source generates negative pressure at a location proximately thereto.
7. A transport assembly according to claim 6 wherein the channel is sized and adapted to nestably receive a tubular container.
8. A transport assembly according to claim 1 wherein said constraining mount slidably engages said load arm so that when said drive shaft moves said actuator arm, said load arm may slide relative to said constraining mount.

9. A transport assembly according to claim 8 wherein said constraining mount is rotatable about a rotation axis so that when said drive shaft moves said actuator arm, said load arm can rotate with said constraining mount about the rotation axis as said load arm slides relative to said constraining mount.

10. A transport assembly according to claim 1 including a plunger assembly including:

- (A) a plunger rod;
- (B) a plunger head supported by said plunger rod; and
- (C) a plunger actuator operative to reciprocate said plunger rod and thereby move said plunger head so that said plunger head assists said transport head in placing the selected container in the second station.

11. A transport assembly according to claim 10 wherein said plunger assembly includes

- (A) a housing wherein at least a portion of said plunger rod is disposed in said housing;
- (B) a camming slot formed in said housing; and
- (C) a follower peg disposed on said plunger rod and positioned to engage the camming slot thereby to control the movement of said plunger rod and said plunger head upon reciprocation of said plunger rod.

12. A transport assembly according to claim 11 wherein the camming slot has a longitudinal portion and an arcuate portion so that said plunger head moves between

- (A) a disengaged position wherein said plunger head is offset from the second station,

(B) an aligned position wherein said plunger head is aligned with the selected container when said transport head is in the container placement position, and

(C) an engaged position wherein said plunger head is in contact with the selected container thereby to assist its placement in the second station.

13. A transport assembly according to claim 11 wherein said plunger actuator includes a lever that moves between a first lever position and a second lever position thereby to reciprocate said plunger rod.

14. A transport assembly according to claim 13 wherein said plunger actuator includes a cam drive acting on said lever to move said lever between the first lever position and the second lever position.

15. A transport assembly according to claim 1 including a height adjustable support post operative to vary the height of said support frame relative to a support surface.

16. A container transport apparatus operative to transport containers one at a time from a first station located at a supply bin to a receiving platform and place the containers in a second station defined by an opening associated with the receiving platform that is sized and adapted for receiving and holding a container, comprising:

(A) a transport assembly, including

(1) a support frame;

(2) an actuator arm;

(3) a load arm coupled to said actuator arm;

(4) a transport head supported by said load arm that is sized and adapted to engage a container;

- (5) an actuator drive operative to simultaneously move said actuator arm and said load arm thereby to move said transport head between
 - (i) a container collection position wherein said transport head engages a selected container to be transported to the receiving platform, and
 - (ii) a container placement position wherein the engaged container is positioned proximately to a selected opening associated with the receiving platform; and
- (B) a plunger assembly, including
 - (1) a plunger rod;
 - (2) a plunger head supported by said plunger rod;
 - (3) a plunger actuator operative to reciprocate said plunger rod and thereby move said plunger head so that said plunger head assists with the placement of the engaged container in the second station, said plunger head being movable between
 - (i) a disengaged position wherein said plunger head is offset from said engaged container,
 - (ii) an aligned position wherein said plunger head is aligned with the engaged container, and
 - (iii) an engaged position wherein said plunger head is in contact with the engaged container.

17. A container transport apparatus according to claim 16 wherein said transport head is a vacuum head and including a vacuum source, said vacuum head in fluid communication with said vacuum source.

18. A container transport apparatus according to claim 17 wherein said vacuum head has

- (A) a channel formed therein to receive the container, and
- (B) at least one aperture located in the channel wherein said vacuum source generates negative pressure at a location proximately thereto and engage the container.

19. A container transport apparatus according to claim 18 wherein the channel is sized and adapted to receive a tubular container.

20. A container transport apparatus according to claim 16 wherein said plunger assembly includes

- (A) a housing wherein at least a portion of said plunger rod is disposed in said housing;
- (B) a camming slot formed in said housing; and
- (C) a follower peg disposed on said plunger rod and positioned to engage the camming slot thereby to control the movement of said plunger rod and said plunger head upon reciprocation of said plunger rod.

21. A container transport apparatus according to claim 16 wherein said plunger actuator includes a lever that moves between a first lever position and a second lever position thereby to reciprocate said plunger rod.

22. A container transport apparatus according to claim 21 wherein said plunger actuator includes a cam drive acting on said lever to move said lever between the first lever position and the second lever position.

23. A container transport apparatus according to claim 16 wherein said transport head is located above the containers in the supply bin when said transport head is in the container collection position.

24. A container transport apparatus for use during the production of filled tube products that is operative to sequentially transport unfilled tubular containers, each having a cylindrical sidewall formed at a common radius of curvature, from a supply of such tubular containers located at first station and thereafter to insert an end portion of each said tubular container into a respective second station that has an opening that is sized and adapted for receiving the end portion of each said tubular container, comprising:

- (A) a support frame;
- (B) an actuator arm;
- (C) a load arm coupled to said actuator arm;
- (D) a vacuum head supported by said load arm and in fluid communication with a vacuum source, said vacuum head having a suction channel formed therein formed at a channel radius of curvature that is about the same as the common radius of curvature of said tubular containers;
- (E) an actuator drive operative to simultaneously move said actuator arm and said load arm thereby to move said vacuum head between
 - (1) a container collection position wherein said vacuum head engages a selected tubular container, and
 - (2) a container placement position wherein said vacuum head inserts the end portion of said selected tubular container into the second station;

25. A tubular container transport apparatus according to claim 24 including a rotatable constraining mount disposed on said support frame that is rotatable about a rotation axis and that slidably engages said load arm so that when said actuator

drive moves said actuator arm, said load arm can rotate with said constraining mount about the rotation axis as said load arm slides relative to said constraining mount.

26. A tubular container transport apparatus according to claim 24 including a plunger assembly including:

- (A) a plunger rod;
- (B) a plunger head supported by said plunger rod and sized to nestably engage an end of the tube container;
- (C) a plunger actuator operative to reciprocate said plunger rod and thereby move said plunger head so that said plunger head assists with the insertion of the tube container into the second station, said plunger head being movable between
 - (1) a disengaged position wherein said plunger head is offset from the engaged tube container,
 - (2) an aligned position wherein said plunger head is aligned with the engaged tube container, and
 - (3) an engaged position wherein said plunger head is in contact with the engaged tube container.

27. A tubular container transport apparatus according to claim 26 wherein said plunger assembly includes

- (A) a housing wherein at least a portion of said plunger rod is disposed in said housing;
- (B) a camming slot formed in said housing; and
- (C) a follower peg disposed on said plunger rod and positioned to engage the camming slot thereby to control the movement of said plunger rod and said plunger head upon reciprocation of said plunger rod.

28. A tubular container transport apparatus according to claim 27 wherein the camming slot has a longitudinal portion and an arcuate portion so that said plunger head moves between

(A) a disengaged position wherein said plunger head is offset from the second station,

(B) an aligned position wherein said plunger head is aligned with the selected container when said transport head is in the container depositing position, and

(C) an engaged position wherein said plunger head is in contact with the selected container thereby to assist its placement in the second station.

29. A tubular container transport apparatus according to claim 27 wherein said plunger actuator includes a lever that moves between a first lever position and a second lever position thereby to reciprocate said plunger rod.

30. A tubular container transport apparatus according to claim 29 wherein said plunger actuator includes a cam drive acting on said lever to move said lever between the first lever position and the second lever position.

31. A transport assembly according to claim 24 including a height adjustable support post operative to vary the height of said support frame relative to a support surface.

32. A method of sequentially transporting empty containers from a first station and placing them into a second station spaced from the first station so that the container is available for further processing operations wherein said empty containers each have a sidewall and first and second end portions and wherein the second station is adapted to matably receive the first end portion of each of said containers, comprising:

- (A) loading a bulk supply of containers single file in a supply bin located at the first station;
- (B) releasably engaging the sidewall of a selected one of said containers;
- (C) thereafter transporting the selected one of said containers to the second station and orienting the selected one of said containers such that the first end portion thereof is proximate to the second station;
- (D) thereafter applying a force to the second end portion of the selected one of said containers thereby to advance it into a mated engagement with the second station while maintaining engagement of the sidewall of the selected one of said containers;
- (E) thereafter both releasing the sidewall and removing the force from the second end portion of the selected one of said containers; and
- (F) repeating steps (A)-(E).

33. A method according to claim 32 wherein the step of applying force to the second end portion of the selected one of said containers is accomplished by applying a mechanical force.

34. A method according to 32 wherein the step of engaging the sidewall of the selected one of said containers is accomplished by applying a suction thereto.

35. A method according to claim 32 wherein said containers are elongated and wherein the step of loading a bulk supply of containers orients said containers horizontally and wherein the step of orienting the selected one of said containers positions the selected one of said containers generally vertically.